

What is claimed is:

1. An isolated protein comprising an amino acid sequence as depicted in Figure 5 (SEQ ID NO:8).
- 5 2. An isolated protein comprising an amino acid sequence as depicted in Figure 3A (SEQ ID NO:10).
3. An isolated protein consisting of an amino acid sequence as depicted in Figure 5  
10 (SEQ ID NO:8)
4. An isolated protein consisting of an amino acid sequence as depicted in Figure 3A  
(SEQ ID NO:10).
- 15 5. An isolated protein, the amino acid sequence of which consists of a catalytic domain defined by amino acids numbers 28-380 as depicted in Figure 5 (SEQ ID NO:8) or amino acids numbers 1-353 as depicted in Figure 3A (SEQ ID NO:10).
6. A chimeric protein comprising the protein of Claim 3 fused by a covalent bond to at  
20 least a portion of a second protein, which second protein is not said protein defined by the sequence as depicted in Figure 5 (SEQ ID NO:8).
7. A chimeric protein according to Claim 6 wherein second protein is protein A and  
which portion is the IgG binding domain.
- 25 8. A chimeric protein comprising the protein of Claim 4 or 5 fused by a covalent bond to at least a portion of a second protein, which second protein is not said protein defined by the sequence as depicted in Figure 5 (SEQ ID NO:8).
- 30 9. A chimeric protein according to Claim 8 wherein second protein is protein A and  
which portion is the IgG binding domain.
10. An isolated nucleic acid comprising a nucleotide sequence as depicted in Figure 5  
(SEQ ID NO:7).

11. An isolated nucleic acid comprising a nucleotide sequence as depicted in Figure 3A (SEQ ID NO:9).

12. An isolated nucleic acid comprising a nucleotide sequence encoding an amino acid sequence as depicted in Figure 5 (SEQ ID NO:8) or its reverse complement.

5 13. An isolated nucleic acid comprising a nucleotide sequence encoding an amino acid sequence as depicted in Figure 3A (SEQ ID NO:10) or its reverse complement.

10 14. An isolated RNA molecule comprising a nucleotide sequence as depicted in Figure 5 (SEQ ID NO:7), wherein the base U (uracil) is substituted for the base T (thymine) of said sequence.

15 15. An isolated RNA molecule comprising a nucleotide sequence as depicted in Figure 15 3A (SEQ ID NO:9), wherein the base U (uracil) is substituted for the base T (thymine) of said sequence.

16. An isolated RNA molecule comprising a nucleotide sequence encoding an amino acid sequence as depicted in Figure 5 (SEQ ID NO:8).

20 17. An isolated RNA molecule comprising a nucleotide sequence encoding an amino acid sequence as depicted in Figure 3A (SEQ ID NO:10).

18. A vector comprising: (a) a nucleotide sequence as depicted in Figure 5 (SEQ ID 25 NO:7); and (b) an origin of replication.

19. The vector of Claim 18 wherein the nucleotide sequence is operably linked to a heterologous promoter.

30 20. A vector comprising: (a) a nucleotide sequence as depicted in Figure 3A (SEQ ID NO:9); and (b) an origin of replication.

21. The vector of Claim 20 wherein the nucleotide sequence is operably linked to a heterologous promoter.

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22. A vector comprising: (a) a nucleotide sequence that is the reverse complement to all or a fragment of the nucleotide sequence as depicted in Figure 5 (SEQ ID NO:7); and (b) an origin of replication.

5 23. The vector of Claim 22 wherein the nucleotide sequence is operably linked to a heterologous promoter.

24. A vector comprising: (a) a nucleotide sequence encoding an amino acid sequence as depicted in Figure 5 (SEQ ID NO:8) and (b) an origin of replication.

10 25. A vector comprising: (a) a nucleotide sequence encoding an amino acid sequence as depicted in Figure 3A (SEQ ID NO:10) and (b) an origin of replication.

15 26. A recombinant cell containing a recombinant nucleic acid vector comprising a nucleotide sequence as depicted in Figure 5 (SEQ ID NO:7).

27. The recombinant cell of Claim 26 wherein the cell is a eukaryotic cell.

28. The recombinant cell of Claim 26 wherein the cell is a mammalian cell.

20 29. A recombinant cell containing a recombinant nucleic acid vector comprising a nucleotide sequence as depicted in Figure 3A (SEQ ID NO:9).

30. The recombinant cell of Claim 29 wherein the cell is a prokaryotic cell.

25 31. The recombinant cell of Claim 29 wherein the cell is a bacterial cell.

32. A method of producing a rat  $\alpha 1 \rightarrow 2$ fucosyltransferase protein comprising:

30 (a) culturing a recombinant cell containing the vector of Claim 18 such that the  $\alpha 1 \rightarrow 2$ fucosyltransferase protein, encoded by the nucleotide sequence SEQ ID NO:7 contained in said vector, is expressed by the cell; and

35 (b) recovering the expressed protein or a cellular fraction containing said protein.

35 33. An isolated or purified protein produced by the method of Claim 32.

34. A cellular fraction with protein activity produced by the method of Claim 32.

35. A method of producing a rat  $\alpha 1 \rightarrow 2$ fucosyltransferase protein comprising:  
5 (a) culturing a recombinant cell containing the vector of Claim 20 such that the  
 $\alpha 1 \rightarrow 2$ fucosyltransferase protein, encoded by the nucleotide sequence SEQ ID NO:9  
contained in said vector, is expressed by the cell; and  
(b) recovering the expressed protein or a cellular fraction containing said protein.

10 36. An isolated or purified protein produced by the method of Claim 35.

37. A cellular fraction with protein activity produced by the method of Claim 35.

38. A method of producing a rat  $\alpha 1 \rightarrow 2$ fucosyltransferase protein comprising:  
15 (a) culturing a recombinant cell containing the vector of Claim 24 such that the  
 $\alpha 1 \rightarrow 2$ fucosyltransferase protein, encoded by the nucleotide sequence SEQ ID NO:7  
contained in said vector, is expressed by the cell; and  
(b) recovering the expressed protein or a cellular fraction containing said protein.

20 39. An isolated or purified protein produced by the method of Claim 38.

40. A cellular fraction with protein activity produced by the method of Claim 38.

25 41. A method of producing a rat  $\alpha 1 \rightarrow 2$ fucosyltransferase protein comprising:  
(a) culturing a recombinant cell containing the vector of Claim 25 such that the  
 $\alpha 1 \rightarrow 2$ fucosyltransferase protein, encoded by the nucleotide sequence SEQ ID NO:9  
contained in said vector, is expressed by the cell; and  
(b) recovering the expressed protein or a cellular fraction containing said protein.

30 42. An isolated or purified protein produced by the method of Claim 41.

43. A cellular fraction with protein activity produced by the method of Claim 41.

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44. A method for detecting the onset of cancer comprising the detection of a nucleotide sequence as depicted in Figure 5 (SEQ ID NO:7) or a fragment or complement thereof.

45. A method to suppress or inhibit in a cell the function of an  $\alpha 1 \rightarrow 2$ fucosyltransferase 5 protein, said method comprising contacting a cell with a nucleic acid comprising a nucleotide sequence that is the reverse complement of a nucleotide sequence as depicted in Figure 5 (SEQ ID NO:7) or a fragment thereof, or as depicted in Figure 3A (SEQ ID NO:9) or a fragment thereof, and wherein said nucleic acid is RNA, the base T (thymine) in SEQ ID NO:7 and SEQ ID NO:8 is substituted by the base U (uracil).  
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46. The method of Claim 45, wherein said nucleic acid is contained within an adenoviral or retroviral vector.

47. The method of Claim 45, wherein said cell is a human small cell lung carcinoma 15 cell.

48. A method for the preparative synthesis of a molecule comprising  $Fuc\alpha 1 \rightarrow 2Gal\beta 1 \rightarrow 3GalNAc$ , said method comprising contacting the isolated or purified rat 20  $\alpha 1 \rightarrow 2$ fucosyltransferase of Claim 1, 2, 3, 4, 5, 6 or 8 with GDP-fucose and a molecule having a terminal  $Gal\beta 1 \rightarrow 3GalNAc$  moiety and recovering a molecule comprising  $Fuc\alpha 1 \rightarrow 2Gal\beta 1 \rightarrow 3GalNAc$ .

49. A method for the preparative synthesis of a glycolipid, glycoprotein, 25 glycolipoprotein or free oligosaccharide comprising  $Fuc\alpha 1 \rightarrow 2Gal\beta 1 \rightarrow 3GalNAc$ , said method comprising contacting the isolated or purified rat  $\alpha 1 \rightarrow 2$ fucosyltransferase of Claim 1, 2, 3, 4, 5, 6 or 8 with GDP-fucose and a glycolipid, glycoprotein, glycolipoprotein or oligosaccharide having a terminal  $Gal\beta 1 \rightarrow 3GalNAc$  moiety and recovering a glycolipid, 30 glycoprotein, glycolipoprotein or free oligosaccharide comprising  $Fuc\alpha 1 \rightarrow 2Gal\beta 1 \rightarrow 3GalNAc$ .

50. The method according to Claim 49 wherein the rat  $\alpha 1 \rightarrow 2$ fucosyltransferase is 35 contacted with an oligosaccharide comprising a terminal  $Gal\beta 1 \rightarrow 3GalNAc$  moiety.

51. A method for the preparative synthesis of fucosyl-GM<sub>1</sub> comprising contacting the isolated or purified rat  $\alpha 1 \rightarrow 2$ fucosyltransferase of Claim 1, 2, 3, 4, 5, 6 or 8 with GDP-fucose and the ganglioside GM<sub>1</sub> and recovering fucosyl-GM<sub>1</sub>.

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52. A method for the preparative synthesis of a molecule comprising Fu $\alpha 1 \rightarrow 2$ Gal $\beta 1 \rightarrow 3$ GalNAc, said method comprising contacting the isolated or purified rat  $\alpha 1 \rightarrow 2$ fucosyltransferase of Claim 33, 36, 39, or 42 or the cellular fraction of Claim 34, 37, 10 40, or 43 with GDP-fucose and a molecule having a terminal Gal $\beta 1 \rightarrow 3$ GalNAc moiety and recovering a molecule comprising Fu $\alpha 1 \rightarrow 2$ Gal $\beta 1 \rightarrow 3$ GalNAc.

53. A method for the preparative synthesis of a glycolipid, glycoprotein, glycolipoprotein or free oligosaccharide comprising Fu $\alpha 1 \rightarrow 2$ Gal $\beta 1 \rightarrow 3$ GalNAc, said 15 method comprising contacting the isolated or purified rat  $\alpha 1 \rightarrow 2$ fucosyltransferase of Claim 33, 36, 39, or 42 or the cellular fraction of Claim 34, 37, 40, or 43 with GDP-fucose and a glycolipid, glycoprotein, glycolipoprotein or oligosaccharide having a terminal Gal $\beta 1 \rightarrow 3$ GalNAc moiety and recovering a glycolipid, glycoprotein, glycolipoprotein or free 20 oligosaccharide comprising Fu $\alpha 1 \rightarrow 2$ Gal $\beta 1 \rightarrow 3$ GalNAc.

54. The method according to Claim 53 wherein the rat  $\alpha 1 \rightarrow 2$ fucosyltransferase is contacted with an oligosaccharide comprising a terminal Gal $\beta 1 \rightarrow 3$ GalNAc moiety.

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55. A nutritional formula composition comprising the glycolipid, glycoprotein, glycolipoprotein or oligosaccharide obtained by the method of Claim 49.

56. A nutritional formula composition comprising the glycolipid, glycoprotein, 30 glycolipoprotein or oligosaccharide obtained by the method of Claim 53.

57. A nutritional formula composition comprising the oligosaccharide obtained by the method of Claim 50.

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58. A nutritional formula composition comprising the oligosaccharide obtained by the method of Claim 54.

59. A method for the preparative synthesis of fucosyl-GM<sub>1</sub> comprising contacting the isolated or purified rat  $\alpha$ 1→2fucosyltransferase of Claim 33, 36, 39, or 42 or the cellular fraction of Claim 34, 37, 40, or 43 with GDP-fucose and the ganglioside GM<sub>1</sub> and recovering fucosyl-GM<sub>1</sub>.

10 60. A method to induce an immunotherapeutic or immunosuppressive action against a fucosyl-GM<sub>1</sub>-producing disease, comprising administering fucosyl-GM<sub>1</sub> to a human patient with said disease .

15 61. The method of Claim 60 wherein said disease is cancer or neurological disease.

62. The method of Claim 60 wherein said disease is small cell lung carcinoma.

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